

CRANES, HOISTS, LIFTING DEVICES, AND RIGGING EQUIPMENT

Los Alamos National Laboratory

Laboratory Implementation Requirement LIR 402-1120-01.1

Original Issue Date:12/02/02, Revised:12/08/04

Mandatory Document

1.0 Introduction

Lessons Learned [Click here](#) for Lessons Learned that may apply to the requirements in this LIR.

1.1. Background Hoisting and rigging operations present a serious hazard to trained and untrained personnel. Each year, many workers across the country are killed or injured while operating or working with or around this type of equipment because they did not recognize or anticipate the potential dangers associated with the particular task to be performed. As a result, the Occupational Health and Safety Administration (OSHA) established specific guidelines for identifying, monitoring, evaluating, and training personnel who must work on or around mechanized equipment and hoisting and rigging operations.

The requirements contained in this Laboratory Implementation Requirement (LIR) provide a systematic approach to managing hazards associated with hoisting and rigging equipment work. Implementation of these requirements mitigates potential serious injuries, illness, and fatalities. The essential elements include required training, equipment certification, and inspection and maintenance requirements. These elements must be implemented to ensure workers can safely work with cranes, aerial lifts, hoists, shop cranes and rigging equipment while performing construction, routine maintenance, emergency repairs, or inspections.

The expectations contained in this LIR are based on the requirements in 29 CFR 1910 and 1926 "Occupational Safety and Health Standards," the ANSI B30 series documents, and the [Department of Energy Hoisting and Rigging Standards 1090-99](#). This LIR replaces AR 13-2, "Cranes, Hoists, Lifting Devices, and Rigging" and complements LPR 402-00-00, Appendix 14.

The requirements in this document shall become effective immediately on the issue date.

1.2 In this Document

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2.0 Purpose

This LIR provides specific requirements that shall be implemented for protecting hoisting and rigging and mechanized equipment workers, other personnel, and government property from the hazards associated with mechanized equipment, cranes, and associated equipment utilized in hoisting and rigging operations. These requirements must be implemented prior to and during hoisting and rigging operations at Los Alamos National Laboratory (LANL).

The requirements contained in this LIR and all provisions of federal, state, and local regulations shall be considered the minimum safety requirements for hoisting and rigging operations at LANL.

3.0 Scope/Applicability

The requirements contained in this LIR shall apply to activities involving mechanized equipment, cranes, hoists and to all other hoisting and rigging operations performed at LANL.

4.0 Definitions

4.1 Terms **Below-hook lifting device** – A device used in lifting/lowering operations that, used singularly or in combination, alters or transfers the direction or sequence of loading from the lifting device to the load.

Guidance Note: This type of device includes lifting bars, spreader bars, swivels, and other such equipment.

Certified or licensed – Possessing a license or certificate issued by a recognized authority attesting that a worker has been trained and/or tested and is competent and qualified to perform specific tasks or operate specific equipment.

Cone of safety – An area in which personnel and equipment are separated from a hoisted load by distance.

Guidance Note: Physical barricades, posting, or continuous monitoring may be used to designate the area.

Critical Lift (also known as a high-consequence lift) – Parts, components, assemblies, or lifting operations designated by the management or customer that, if involved in an accident, could• present a significant risk of personal injury or property damage;

- cause a release of significant amounts of hazardous material;
- cause undetectable damage resulting in future operational or safety concerns at a facility; or
- cause an unacceptable operational or programmatic impact.

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Guidance Note: The following should be considered for designating a critical lift:

- Any lift exceeding 75% of the manufacturer's rated capacity for the crane, hoist, or mechanized equipment to be used in the lift.
- Any item that requires special care in handling because of weight, size, asymmetrical shape, undetermined center of gravity, installation tolerances, or other unusual factors.
- Any lift using two or more cranes, hoists, pieces of mechanized equipment, or a combination of such equipment.
- An otherwise non-critical lift that must be made in close proximity to critical or expensive items which could be damaged as a result of contact with a hoisted load.
- Any lift where the crane, hoist, or mechanized equipment could at any time come in contact with an energized high voltage power line.
- Any lift that requires personnel to be hoisted.

Critical Lift Plan – A written document that contains elements outlined in section 6.0 of this LIR.

Defect – Any characteristic or condition that may weaken or reduce the strength of a material or object of which it is a part.

General purpose installed lifting device (GPILD) – Cranes and hoists installed as part of the original building construction or commercially available cranes and hoists that are attached to a building or other structure.

High voltage – All voltages of 600 volts or greater, unless otherwise defined in the text of this LIR.

Hoist – A powered or manual device used to raise and lower a load. A hoist may be fixed or an integral part of a crane mechanism.

Hoisting – Any operation using powered or mechanical lifting devices such as chain falls, tuggers, shop cranes, mobile cranes, forklifts, wheel or track loaders, or hoists to raise or lower personnel, equipment, or materials.

Incidental crane operator – A person who is certified to operate overhead cranes and hoists in routine work activities for ordinary lifts that are usually of low weight relative to the crane's rated capacity.

Guidance Note: Routine work activities do not include critical lifts or operation of mobile cranes.

Mobile crane – A machine with a mechanism for travel that allows loads to be lifted and swung at various radii. Mobile cranes include crawler cranes, wheel-mounted truck or self-propelled cranes, and other cranes with similar characteristics.

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Mobile Crane Operator—A person who is certified to operate mobile cranes who has successfully completed the training for mobile crane operators and has met the experience requirements listed in section 5.2 or a person that possesses a current New Mexico State License under the Hoisting Operators Safety Act.

Non-installed lifting device (NILD) – Commercially available or laboratory-built lifting devices such as come-alongs, chain falls, tuggers, shop cranes, block and tackle devices, and specially built onsite devices that are used to lift or lower equipment or materials.

Ordinary lift – Any lift that does not meet the criteria of a critical lift and is not required to be documented unless a determination is made by personnel responsible for the lift that it should be documented.

Overhead crane – A machine that uses a hoist and rigging to lift, lower, or horizontally move a load. Overhead cranes include overhead bridge, monorail, and jib cranes.

Person-in-Charge—The responsible person appointed by the owning Division Group Leader for the safe handling of critical loads and for the safe handling of noncritical items in, around, or above spaces in which critical items are located and is trained as a qualified crane operator and rigger.

Qualified person – One who possesses a recognized degree, certificate, or professional standing or has extensive knowledge, training and experience in a related or applicable field, and who has successfully demonstrated his/her ability to solve or resolve complex issues related to the subject matter, the work, or the project.

Qualified crane operator – A person certified or licensed to operate all types of overhead cranes and hoists.

Guidance Note: A Qualified Crane Operator may perform the duties of the PIC for critical lifts, although he/she shall not operate equipment during the critical lift.

Designated Leader- The responsible person designated for each project who is responsible for all aspects of an Ordinary Lift and who is trained as an incidental crane operator, qualified crane operator or a rigger.

Rigger – A person who is authorized to inspect rigging equipment, performs the tasks associated with hoisting and rigging operations and has at a minimum completed the incidental crane operators and rigging safety course.

Rigging – Wire rope slings, alloy steel chains, synthetic rope or web slings, shackles, eyebolts, and special devices, such as below-hook lifting devices that are used either singularly or in combination to attach a load to a lifting device.

Safety factor - The ratio of the ultimate breaking strength of a member or piece of material or equipment to the actual working stress or safe working load when in use.

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Signal person – A person who communicates directions to and from the operator(s) using ANSI standard hand signals or voice communication and meets the definition of qualified person as outlined in this LIR.

Special purpose installed lifting devices—Commercially available or Laboratory build cranes and hoists that serve a specific experimental or operational purpose. They are installed in an experimental or process system or are attached to the building or other structure.

4.2 ANSI—American National Standards Institute

Acronyms AWS—American Welding Society

CFR—Code of Federal Regulations

DOE—Department of Energy

FWO-SEM—Facility and Waste Operations-Standards, Engineering and Maintenance Group

GPILD—general purpose installed lifting device

LANL—Los Alamos National Laboratory

NILD—non-installed lifting device

OSHA—Occupational Safety and Health Administration

PIC—person-in-charge

PPE—personal protective equipment

SERLM—Safety and Environmental Responsible Line Manager

SPILD—special purpose installed lifting device

5.0 Implementation Requirements — Personnel

5.1

Roles and Responsibilities

Who	Shall
Group Leader or Operations Manager or designee	<ul style="list-style-type: none">• Identify in writing (by name and Z Number) the Incidental or Qualified Crane Operator, and Rigger, Mobile Crane Operator for hoisting and rigging operations.• Ensure that the safety training requirements for hoisting and rigging operations are current for employee qualification.• Ensure that equipment defined in this LIR is correctly designed, certified, inspected and maintained prior to being used for hoisting and rigging operations.• Appoint a person-in-charge (PIC) for critical lifts and a designated leader for ordinary lifts.• Inform affected employees of the existence, location, and dangers posed by hoisting and rigging operations.• Be knowledgeable concerning the determining factors of a critical lift.

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Group Leader or Operations Manager or designee (Continued)	<ul style="list-style-type: none">• Ensure a qualified person completes a formal review of all Critical Lift Plans.• Ensure that equipment that is unsafe or defective is removed from service in accordance with LIR 402-860-02, Locking and Tagging Equipment, Machinery or Systems.• Maintain documentation related to hoisting and rigging operations (e.g., Activity Hazard Analysis (AHA), Hazard Control Plans HCP's, ordinary lift plan, critical lift plan, inspections, maintenance and training certifications, etc. for a period consistent with LIR 308-00-02 Laboratory Records Management. Guidance Note: An HCP may be used for critical lifts that are repetitive in nature.• Submit to the ESH Training Group (HSR-13) the names of prospective operators, rigging supervisors, and riggers; the equipment to which they will be assigned, and the duties they will perform; and the type of certification being requested for Application for Operator Certification for Cranes, Hoists, and Rigging (Form 1486/ESH Form 13-2L).• Obtain written certification of medical qualification records.• Maintain records of currently certified operators, rigging supervisors, and riggers.
Designated Leader	<ul style="list-style-type: none">• be designated by the group leader, operations manager or designee to provide the input into the classification of hoisting and rigging operations either as ordinary or critical in accordance with the requirements contained in this LIR.• recommend that an Ordinary Lift Plan be completed or assist with the development of a Critical Lift Plan for lifts classified as critical lifts to ensure that all hazards have been identified, controls implemented, and the employees performing the work have been trained in accordance with the requirements contained in this LIR.• review the Ordinary Lift Plan after it is completed with input from operating and rigging personnel and affected employees.• ensure that all required Personal Protective Equipment (PPE) is available and used as required before the start of the project. Selection and use of PPE shall be in accordance with LIR 402-1000-01.• stop work in accordance with LIR 401-10-01 as required.• prevent unauthorized individuals from attempting to work in or around hoisting and rigging operations by establishing a cone of safety.

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Designated Leader (Continued)	<ul style="list-style-type: none">• ensure that employees are current on training requirements, have received instructions regarding the hazards involved, precautions to be taken, and the equipment to be used.• be knowledgeable about hoisting and rigging limitations and parameters, and be able to demonstrate proficiency in reviewing and implementing all aspects of the Ordinary Lift Plan if completed.• determine that conditions remain consistent with the terms of the Ordinary Lift Plan and ensure that required safe work conditions are maintained.• consult with HSR-5 for technical assistance and/or resource materials.
Incidental Operator and Rigger	<ul style="list-style-type: none">• possess a current LANL Incidental Crane Operator and Rigger license.• ensure that the weight of the object is known and is lifted within the limits of the equipment being used.• operate GPILDs, NILDs, and overhead cranes for ordinary lifts.• know the hazards that may be encountered during hoisting and rigging operations and perform the lift as documented in the ordinary lift procedure if one is completed.• complete hoisting and rigging operations in accordance with hoisting and rigging safe practices.• use hoisting and rigging equipment and PPE as required and as designed.• alert the designated leader whenever he/she recognizes a warning sign or symptom of a dangerous situation or detects a prohibited situation.• stop work as quickly as possible whenever a dangerous or prohibited situation is detected in accordance with the Laboratory Stop Work LIR 402-10-01.
Qualified Crane Operator and Rigger	<ul style="list-style-type: none">• possess a current LANL Qualified Crane Operator and Rigger license.• operate all hoisting and rigging equipment specified under the licensed designation.• perform duties of the person in charge of critical lifts, although he/she must not operate a crane while performing these duties.• perform the lift in accordance with the critical lift plan or ordinary lifts.• complete hoisting and rigging operations in accordance with hoisting and rigging safe practices.

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Qualified Crane Operator and Rigger (Continued)	<ul style="list-style-type: none">• only operate equipment that is current on required inspections and maintenance.• know the hazards that may be typically encountered during hoisting and rigging operations.• alert the person-in-charge when he/she recognizes a condition that is not being implemented in accordance with the requirements contained in this LIR.• stop work in accordance with the Laboratory Stop Work LIR 402-10-01.
Person-in-Charge (PIC)	<ul style="list-style-type: none">• possess a current LANL Qualified Operator license.• review the Critical Lift Plan with the qualified person (when required) and return the plan to the responsible supervisor (with or without comments) before the start of the project.• provide the qualified person with technical assistance and resource materials as required to support the informational and instructional requirements of the work to be accomplished.• assist in the development and implementation of all Critical Lift Plans.• ensure that a pre-job briefing is conducted with the employees designated to work at or around the hoisting and rigging operation. Topics for the briefing shall include but are not limited to anticipated hazards, controls to be implemented, communications, required PPE, and emergency telephone numbers.• ensure hoisting and rigging equipment is current on required inspections and maintenance.• ensure personnel involved in the lift are current on required training.• stop work in accordance with the provision of the Stop Work LIR 402-10-01.
HSR-5 or Other Qualified Person	<ul style="list-style-type: none">• review the Ordinary Lift Plan or Critical Lift Plan upon request and all other safety-related documents and return comments to the designated leader or PIC before the start of the project.• upon request, assist the hoisting and rigging personnel in determining whether or not the lift shall be designated a critical lift and assist with preparation of a Critical Lift Plan that must meet the requirements contained in this LIR.• upon request, conduct and document periodic inspections of hoisting and rigging operations and review findings with the owning division group leader or subcontractor operations manager.

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HSR-5 or Other Qualified Person (Continued)	<ul style="list-style-type: none">• ensure that reviews and revisions of the requirements contained in this LIR are performed as required.• upon request, assist operating groups, contractors, and subcontractors in establishing programs to ensure the requirements of this LIR are implemented.
PS-13	<ul style="list-style-type: none">• coordinate training and provide licenses for incidental and qualified crane operators and riggers and mobile crane operators upon completion of the training requirements contained in this LIR.• ensure that all training developed by laboratory organizations, contractors, subcontractors, or vendors meets the requirements contained in this LIR.
FWO-SEM	<ul style="list-style-type: none">• upon request, assist organizations, such as operating groups, or Facility Managers in establishing maintenance and inspection programs.
Support Services Subcontractor	<ul style="list-style-type: none">• upon request, provide inspection and maintenance services for all hoisting and rigging equipment.

5.2 Training Requirements

5.2.1 Hoisting and Rigging Safety Training

Hoisting and Rigging Safety Training shall be the responsibility of the owning division group leader or subcontractor operations manager. Workers shall be required to complete this training when they are first assigned to a hoisting and rigging project. Workers shall complete the Hoisting and Rigging Safety Training every 3 years, although they shall be required to repeat it more frequently if

- there is a change in the employee's assigned duties;
- there is a change in operations that presents a hazard for which an employee has not previously completed training; or
- the owning division group leader, subcontractor operations manager, PIC, or designated leader has reason to believe that requirements in the Ordinary Lift Plan or Critical Lift Plan are not being met or that there are inadequacies in the employee's knowledge or use of plan requirements.

Training records shall be maintained by the owning division group leader or subcontractor operations manager.

Guidance Note: Re-certification of operators who are currently certified or licensed may be re-certified for one additional three-year period upon successful completion of a validated examination and submittal of an application to PS-13.

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5.2.2 Required Specific Training

Incidental Crane Operator and Rigging Training – Required for personnel who must complete the Incidental Crane Operator and Rigging Safety course to operate NILDs, SPLDs, powered mechanized equipment, overhead cranes, and hoists and perform incidental rigging tasks during ordinary lifts as outlined in this LIR.

Qualified Crane Operator and Rigging Training – Required for personnel who must complete the Qualified Crane Operator and Rigging Safety Course to operate overhead, or stationary/pedestal cranes or hoists and perform complex rigging tasks during ordinary and critical lifts.

Mobile Crane Operator and Rigging Training- Required for personnel who must complete the Mobile Crane Operator and Rigging Safety Course to operate mobile cranes and perform incidental or complex rigging tasks during ordinary and critical lifts. Guidance Note: Personnel or contractors who obtain a current State of New Mexico State License are not required to take LANL's training.

Training for Special Dedicated Equipment-Organizations within the Laboratory may develop specific training for equipment that does not meet the definitions of typical lifting devices if the organizations do not perform critical lifts. The training must be approved by PS-13 and must consist of proficiency training in addition to classroom instruction on the following topics:

- operational and visual preoperational inspections (beginning of shift, daily or before use);
- equipment design limitations and operating characteristics;
- operator responsibilities;
- safety features of the equipment;
- safe work practices and emergency procedures; and
- load weight determinations.

Manufacturer- or equipment-specific training (if available) – Required for all personnel who operate, inspect, or maintain equipment outlined in this LIR.

5.2.3 Additional Recommended Training

Guidance Note: The following training is recommended and can be provided through PS-13 for personnel involved in mobile crane operations or hoisting and rigging operations performed in remote locations:

- American Red Cross Cardiopulmonary Resuscitation (CPR) Course or equivalent.
- American Red Cross First Aid Course (Basic).

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5.3

Physical Qualifications

- Operators of Cab-Operated and Pulpit-Operated Cranes must meet the physical qualifications outlined in section 6.2.2 of the [DOE-STD-1090-2001](#) .
- Mobile Crane Operators shall meet the physical qualifications outlined in section 6.2.3 of the [DOE-STD-1090-2001](#) .
- HSR-2 shall provide this certificate for LANL and support service subcontractor personnel. Private physicians shall provide medical certification for other subcontractor personnel.

6.0 Implementation Requirements—Processes

6.1 Ordinary Lift Plans and Critical Lift Plans

6.1.1 Ordinary Lift Plan Requirements

Guidance Note: Ordinary lifts may require a written Ordinary Lift Plan (optional), as determined by either the Designated Leader, Incidental, Qualified or Mobile Crane Operator and Rigger. [Form 1611](#) may be used for Ordinary

- Lifts or the plan **shall** contain, at a minimum, the following:
 - identification of team members and responsibilities for performing a job;
- identification of the item to be rigged, including the name, weight, height, width, and length;
- identification of the lifting equipment and hardware selected which is certified and configured in a safe configuration; and
- pre-lift meeting sign-in sheet.

6.1.2 Critical Lift Plan Requirements

Critical lifts require a written Critical Lift Plan, as determined by either the Group Leader, Person-in-Charge, Designated Leader, Incidental, Qualified or Mobile Crane Operator and Rigger.

All Critical Lift Plans shall contain, at a minimum, the following:

1.	Identification of the designated (PIC)
2.	<p>The requirement that the PIC shall ensure that a pre-job plan or requirements are prepared that the defines the operation and includes the following:</p> <ul style="list-style-type: none">• Identification of the items to be moved, weight, dimensions, center of gravity, flight path, and any hazardous or toxic materials that are present.• Identification of operating equipment to be used by type and rated capacity.• Rigging sketches that include (when required):

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	<ul style="list-style-type: none">a. Identification and rated capacity of slings, lifting bars, rigging accessories, and below the hook lifting devices.b. Load indicating devices.c. Lifting point.d. Sling angles.e. Boom and swing angles.f. Methods of attachment.g. Crane orientations.h. Other factors affecting equipment capacity. <ul style="list-style-type: none">• Operating requirements and special instructions to operators including rigging precautions and safety measures to be implemented.
3.	The requirement that only experienced operators who have been trained and qualified to operate the specific equipment assigned will be authorized to make the lift.
4.	Requirements that ensure only designated, qualified signalers shall give signals to the operators. <i>However, the operator shall obey a STOP signal at all times, no matter who gives the signal.</i>
5.	Current daily, monthly, and annual inspections and/or certifications.
6.	Load charts for each crane, hoist, or other mechanized equipment will be used in the lift.
7.	A requirement that the critical lift plan be reviewed by a qualified person and the PIC prior to making the lift.
8.	The requirement for a pre-lift meeting involving participating personnel shall be conducted prior to making a critical lift. Questions shall be resolved prior to making the lift. This meeting shall be documented on a pre-lift meeting sign in sheet.
9.	A specific expiration date for each critical lift plan. Guidance Note: Critical lifts that are repetitive in nature may be covered in an operating procedure or hazard control plan.
10.	The requirements that will ensure the critical lift plan is make available at the location where the lift is performed.

6.2

Quality Assurance / Quality Control

The owning division group leader or subcontractor operations manager shall

- ensure that hoisting and rigging operations implement the requirements of organization quality plans. The hoisting and rigging aspects must include procurement of hoisting and rigging equipment, inspection, maintenance and consideration to track the life-cycle of the lifting equipment specifically for objects that are repeatedly lifted or that have the potential for failure due to severe service applications.
- ensure that all accidents and incidents involving hoisting and rigging operations are reported in accordance with the Abnormal Event [LIR 402-130-01](#).

6.3

Self-Assessments

The owning division group leader or subcontractor operations manager or designee shall ensure that hoisting and rigging self-assessments are considered in the design of self-assessment plans based on operations and risk in this area.

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7.0 Implementation Requirements —Hoisting and Rigging Equipment

7.1 General Requirements All hoisting equipment, including attachments, shall be designed, installed, inspected, tested, and operated in strict accordance with the manufacturer's or Laboratory construction specifications, ratings, limitations, and operation and maintenance requirements and the implementation requirements contained in this LIR.

All permanently installed personnel or material hoisting equipment to be used during construction shall be inspected, tested, and certified in accordance with the requirements contained in this LIR prior to initial use and at least annually thereafter.

All elevators and personnel and material hoisting systems shall be certified by the federal, state, or local agency having jurisdiction or by an independent entity approved by HSR-5 or FWO-SEM.

7.1.1 Rated load capacity, specifications, and limitations

- Operating groups, contractors, and subcontractors shall adhere to the requirements contained in this LIR or the manufacturer's recommendations (whichever are more stringent) concerning rated load capacity, specifications, and limitations that apply to installation, operation, maintenance, and inspection and testing of all temporarily installed cranes, hoists, and mechanized equipment.
- When information on rated load capacity, specifications, and limitations is not available from the manufacturer, it shall be determined by an internal/external qualified or professional engineer who is competent in the field. All manufacturers' and/or engineers' information, including operating, inspection, and testing instructions, shall be produced in a written form and provided to the HSR-5 or other qualified person before the start of a project.
- No equipment shall be used or installed on a project until the Laboratory engineer and/or manufacturer's data have been reviewed and accepted by owning line organization or Facility Managers.
- The rated load capacities, warnings, and instructions shall be reviewed with and strictly adhered to by the equipment operator(s).
- Except when special tests are being conducted, cranes, hoists, and all other mechanized equipment shall not be

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loaded in excess of posted maximum loads for boom angle, outrigger support, and other limiting factors.

Posting Requirements – Rated load capacities, operating speeds, special warnings, and all other information required by the manufacturer and/or professional engineer and all applicable ANSI standards shall be posted where clearly visible to the operator(s) of the equipment.

7.1.2 Modifications

Modifications, additions, or repairs that could affect the structural competence, capacity, or safe operation of the equipment shall not be made without the manufacturer's written approval or approval of an internal/external qualified or professional engineer competent in the field. When such modifications, additions, or repairs are made, the equipment shall be subject to another performance test and the posted load capacities revised to reflect the changes. Modifications that require performance testing shall include the following:

- re-rigging of hoisting and support systems;
- addition or removal of jibs, boom sections, boom extensions, auxiliary boom noses, or similar attachments;
- repair of critical structural components; and
- removal or addition of counterweights.

7.1.3 Inspections and Performance Tests

- All mobile cranes, overhead cranes, hoists, and mechanized equipment shall be thoroughly inspected and have completed a performance test that demonstrates the equipment's ability to safely handle and maneuver rated loads. These tests and inspections shall be done prior to initial onsite operation and annually thereafter, as well as following major repairs or modifications and whenever required by HSR-5, FWO-SEM, or the Facility Managers.
- Initial and periodic performance inspections and tests shall be conducted on site by a qualified person after the crane hoist or hoisting system has been assembled or reassembled and rigged for operation. The crane inspection form that applies to the crane, hoist or rigging system (i.e., Forms 1489, 1588, 1589, 1590, 1591, 1592) shall be completed and made available to HSR-5 and to Facility Managers for review and approval. Manufacturer, contractor, or owner off-site inspections and tests shall not be substituted for on-site inspections and tests.
- Crawler, locomotive, and wheel-mounted cranes shall be inspected and tested for performance by the contractor and/or owner in accordance with the requirements contained in this LIR and applicable ANSI B30 standards.

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- All other cranes, hoists, GPLDs, SPLDs, installations, and systems described in this section shall be inspected and tested for performance on site under the direct supervision of the manufacturer, responsible design engineer, and/or qualified person approved by HSR-5 and/or owning division group leader or subcontractor operations manager). The inspection(s) and test(s) shall conform to the requirements contained in this LIR and ANSI B30 standards. Following these inspection(s) and test(s) and prior to placing the equipment or system in service, the manufacturer or responsible design engineer or owner shall ensure the following quality assurance documentation is made available to HSR-5 or other qualified person. Prior to formal acceptance by the Laboratory a comprehensive report detailing the results of the initial performance and testing requirements, shall be provided to the owning division group leader and include the following:
 - The recommended periodic inspection, testing, and maintenance requirements and operating and rigging instructions and
 - A written certification stating that the inspected and tested equipment and system(s) meet or exceed the specific requirements of this section and ANSI B30 standards and that the equipment and system(s) are capable of safely performing the intended service.

Inspections for Infrequently Used Overhead Lifting Equipment

Infrequently used overhead lifting equipment may be exempt from monthly inspection requirements if these units are formally locked out of service by either the line organization responsible for the equipment or the Facility Manager. Upon return to service a monthly inspection shall be performed and documented. If the last annual inspection of the out-of-service equipment was conducted more than one year ago, an annual inspection shall be performed by a qualified person before the lifting equipment may be used.

Tagging or Labeling Requirements – All hoisting and rigging equipment shall have a current annual inspection tag ([Form 1594](#)) attached to its exterior that includes the following information:

- make, model, and serial number of the equipment;
- date of the inspection;
- signature of the inspector.

In addition, documentation of inspections and inventories shall be maintained organizationally.

Guidance Note: Color-coding of rigging equipment is acceptable in lieu of tagging based on operational justification.

7.1.4 Pre-Operational Inspection and Maintenance

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- A qualified person shall inspect hoisting equipment for physical defects or unsafe operation prior to use at the start of each shift.
- Any damage or deficiencies shall be corrected prior to use.
- Provisions shall be made for routine lubrication and maintenance of all hoisting equipment.
- Written records of all inspections, deficiencies, and repairs shall be made available for review by the HSR-5 or other qualified person and/or Facility Management representatives upon request.

Equipment that is unsafe or defective shall be locked and tagged in accordance with [LIR402-860-02](#), "Locking and Tagging Equipment, Machinery and Systems."

8.0 References

8.1 [Department of Energy Hoisting and Rigging Standard 1090-99](#)

Documents

[LANL Forms](#)

LANL [LIR402-860-02](#) "Locking and Tagging Equipment, Machinery and Systems"

29 CFR 1910.185, 1910.178, 1910.179, 1910.180, 1926.251, 1926.550, 1926.552, 1926.553, 1926.600, 1926.601, 1926.602, 1926.453 and 1926.604

ANSI B30.5, B30.14, B30.4, B30.3, B30.8, B30.6, B30.16, A92.6, A92.3, A92.2, A90.1, B15.1, B56.1, and B56.6

Power Crane and Shovel Association (PCSA) Standard No. 2

Society of Automotive Engineers (SAE) Standards J682, J1164, J1026, J1152, J1040C, J1116, J1029, J321a, J321b, J185, J1194, J1042, J167, J137.

American Welding Society (AWS) Standards D1.1-72, D14.1-70, D10.9-69.

8.2

Document Ownership

The OIC for this document shall be HSR-5.

8.3

Record-keeping

Design and Load Testing Documentation must be maintained for the entire service life of the equipment by the owning division group or facility manager.

Preoperational inspection records shall be kept for a period of one quarter by the line organization using the equipment.

Monthly inspection records shall be kept for a period of one year by the line organization.

Annual inspection records shall be kept and maintained by line organization for the entire service life of the equipment.

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Note equipment which is required to be maintained for the service life of the equipment may be archived in accordance with LANL record keeping requirements.

Appendix A Overhead and Gantry Cranes

In addition to the requirements stated in this appendix, overhead and gantry crane operations shall conform to all standards in the *current edition* of ANSI B30-2, "Safety Code for Overhead and Gantry Cranes."

Crane access	Access to the cab and/or bridge walkway shall be by a fixed ladder, stairs, or platform with no openings over twelve inches.
Platforms and walkways	Maintenance platforms and walkways shall be protected by standard guardrails and toe-boards, and means of safe access shall be installed on the trolley and bridge. Static safety lines, full body harnesses, and lanyards shall be used when platforms and walkways cannot be installed.
Limit switches and rail stops	Rail-mounted cranes, trolleys, and bridges shall be equipped with both switches and rail stops or buffers at both ends of the track(s).
Rail sweeps	Track-mounted cranes, bridges, and trolleys shall be equipped with rail sweeps extending below the top of the rail and in all effective directions.
Audible warning device	An audible warning-signal device shall be installed on all cranes with power traveling mechanisms except for floor-operated cranes.
Hook limit switches	All overhead and gantry cranes shall be equipped with a hook height limit switch that causes the hoist drum to stop whenever the load hook reaches its maximum specified height.
Operating controls	All controls shall be of the "dead-man" type, which return to the neutral position when released, and the controls shall be plainly marked so that functions are clearly indicated.
Brakes	All brakes shall be designed so that the brake is automatically applied whenever there is a loss of power and cannot be released until power has been restored.

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Appendix B **Overhead Hoists**

The installation, operation, and maintenance of overhead hoists shall be in accordance with the requirements contained in this LIR and ANSI B30.16, "Overhead Hoists (Underhung)."

Design	The hoist manufacturer or a professional engineer competent in the field shall design hoist suspensions and anchorages.
Safe Working Load	The safe working load, as determined by the manufacturer, shall be indicated on the hoist and shall not be exceeded.
Support Structure	The supporting structure shall have a safe working load limit that exceeds by a safety factor of at least 4 to 1 the load limit of the hoist plus the maximum rated load. The support shall provide unobstructed movement of the hoist and load. It shall also permit the operator to stand clear of the load in all hoisting positions.
Limit Switch	Power-operated overhead hoists shall be equipped with a limit switch that prevents the load hook from "two-blocking." Guidance Note: Two-blocking is a condition in which the hook or block contacts the hoist drum or hoist support structure, which can damage or break the wire rope and result in the hook falling onto the floor or ground.
Emergency Stop Switch	In addition to the regular operating controls, power-operated overhead hoists shall be equipped with a manual or automatic switch that will cut off the power supply in case of a malfunction. If the emergency stop switch is manually operated, it shall be where the operator can reach it easily.
Air-Operated Hoists	Air-operated hoists shall be connected to an air supply with the required capacity and working pressure to ensure safe operation of the hoist with maximum load.
Hand-Powered Hoists	Hand-powered hoists shall be of the worm-gear-driven type or equipped with a pawl or ratchet system with a clutch-type break to ensure reliable control and braking.

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Appendix C

C.1 Mobile Cranes

Crawler, Locomotive, and Wheel-Mounted Cranes

In addition to the requirements set forth in this LIR, all crawler, locomotive, and wheel-mounted cranes shall conform with all standards in the current edition of ANSI B30.5 "Safety Standards for Mobile and Locomotive Cranes." Side-boom wheel or crawler tractors shall conform to the requirements of SAE J743 and ANSI.14.

Hydraulic cranes shall conform to the standards set forth in ANSI B30.5 and Power Crane and Shovel Association (PCSA) Standard No. 2. The following shall apply when using mobile type cranes:

Setup	Mobile and crawler cranes shall be set up <ul style="list-style-type: none">to be uniformly level (i.e., level in all directions within one degree in all directions);on rigid blocking covering a surface three times larger than the area covered by the float.
Level Indicator	A means, such as a four-foot carpenters level, shall be provided to enable the operator to visually determine the levelness of the crane.
Boom Angle Indicator	Crawler, locomotive, and wheel-mounted cranes shall be equipped with a boom angle or radius indicator located within the operator's view.
Jib Stops	In addition to boom stops, jibs shall have a positive stop installed to prevent over-topping.
Cab Windows	Windows installed in crane cabs shall be of safety glass that does not distort visibility or otherwise interfere with the safe operation of the crane.
Audible Warning Device	Power cranes shall be equipped with an audible warning-signal device that can be heard above usual construction noise levels.
Barricades	The swing radius area of rotating superstructures of mobile cranes shall be physically barricaded to prevent persons or equipment from being struck by the superstructure
Securing Booms	When not in use, crane booms shall be lowered to the ground or otherwise secured to prevent displacement by wind or other outside forces.
Taglines	Taglines for controlling loads shall be used for protection of personnel, equipment, and structures.

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Equipment Operation Near High-Voltage Lines	<p>Operation of equipment adjacent to high-voltage lines shall be prohibited unless one of the following conditions is satisfied:</p> <ul style="list-style-type: none">• The equipment company or owner of the line has been notified, the line de-energized and grounded, and positive control measures taken to prevent the line from becoming energized prior to completion of the work.• The equipment or any part thereof does not have the capability to come within the following distances from the energized lines: <p>Minimum distances for operation of equipment near high-voltage power lines</p> <ul style="list-style-type: none">• 10 feet from lines of 50 kV or less.• 15 feet from lines of 51 kV to 200 kV• 20 feet from lines of 201 kV to 350 kV• 25 feet from lines of 351 kV to 500 kV• 35 feet from lines of 501 kV to 750 kV• 45 feet from lines of 751 kV to 1000 kV <p>Minimum distances for equipment in transit with no load and the boom and/or mast lowered:</p> <ul style="list-style-type: none">• 4 feet from lines of 0 kV to 0.75 kV• 6 feet from lines of 0.76 to 50 kV• 10 feet from lines of 51 kV to 345 kV• 16 feet from lines of 346 kV to 750 kV• 20 feet from lines of 751 kV to 1000 kV
Posting Requirements	<p>A notice of the above minimum distances shall be posted in the cabs of all cranes, shovels, backhoes, and related equipment which are used in hoisting and rigging applications that may come into contact with high-voltage lines.</p>
Load Drums	<p>Load drums must be equipped with dogs, pawls, or other positive holding devices. At least two full wraps of line shall be maintained on hoisting drums.</p>
Crane-Suspended Personnel Platforms	<ul style="list-style-type: none">• Crane-suspended personnel platforms must be prohibited except when other means of reaching the work site (e.g., personnel hoist, ladder, stairway, aerial lift, etc.) would be hazardous or is not possible because of structural design or work-site conditions.• Crane-suspended personnel platforms must not be used by LANL employees, contractors, vendors, and subcontractors until written authorization is obtained. This authorization shall be granted from HSR-5 or a qualified person and shall implement the requirements outlined in the Suspended Personnel Platform requirements of 29 CFR 1926.550(g).

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Boom Stops	Boom stops must be equipped with a device attached between the gantry or A-frame and the boom chords to limit the elevation of the boom. The device shall control the vertical motions of the boom with gradually increasing resistance from 83 degrees or less, until completely stopping the boom at not over 87 degrees above the horizontal.
Hoisting Ropes	Hoisting ropes must be installed and maintained in accordance with the manufacturer's recommendations. Rotation-resistant and fiber core ropes shall be used only as specified by the manufacturer and then only in accordance with instructions and increased design safety factors required by the manufacturer and/or respective national standards
Hooks and Shackles	Hooks and shackles must meet the requirements of this LIR and applicable ANSI B30 standards. Hooks shall be equipped with approved safety keepers. Shackles used on slings or hoist lines shall be of the locking type or pin secured.
Boom Length Indicators	Boom length indicators must be installed on all boom cranes indicating the boom length from minimum to maximum and is visible to the operator from his position at the controls.
Safe Clearance	Safe clearance must be maintained between moving and rotating parts of a crane and other fixed objects in order to permit safe passage of persons.
Crane and Hoist Signals	<p>Crane and hoist signals must be used in the operation of cranes, derricks, and hoists. Radio, telephone, or a visual and audible electrically operated system shall be used when the signal person cannot be clearly seen by the operator or when the distance between the signal person and the operator exceeds 200 feet.</p> <p>Guidance Note: Hand signals may be used when the distance between the operator and the signal person is less than 200 feet and a clear line of sight has been established.</p>
Signal Systems	Signal systems must be protected from unauthorized use, damage, or interference.
Boom Guards and Proximity Alarms	<p>Boom guards and proximity alarms must not be substituted for maintaining required clearances from electrical energy sources.</p> <p>Guidance Note: Cage-type boom guards, insulating links, and proximity alarms may be used on cranes, shovels, backhoes, and related equipment</p>
Fire Extinguishers	Fire extinguishers must be rated 10 B:C or greater and must be available in the operator's cab of mobile cranes, overhead cranes, and cab-operated cranes.

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C.2 Lift Trucks Used for Hoisting and Rigging

The requirements for using forklifts and powered industrial trucks shall be performed in accordance with [LIR 402-1110-01](#). In addition, the following requirements shall be implemented when forklifts are used in hoisting applications.

Underslung Lifting	<p>All lift trucks used for lifting underslung loads shall have the following:</p> <ul style="list-style-type: none">• a rated capacity chart for such lifting;• a range diagram;• written approval from the HSR-5 SME or other qualified person; and• written approval from the manufacturer.
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Appendix D

Rigging

Ropes, Chains, Slings, and Accessories

D.1 General Requirements

- The use of ropes, slings, and chains shall be in accordance with the safe usage recommendations of the equipment manufacturer, this LIR, 29 CFR 1910.184, and 29 CFR 1926.251.
- Rigging procured from commercial sources shall be manufactured according to the requirements specified in ANSI B30.9 “Slings.”
- A certificate of proof-test or certificate of compliance shall be obtained from the manufacturer for all equipment utilized for critical lifts.
- A certificate of compliance shall be obtained from the manufacturer for all other equipment.
- Rigging manufactured by LANL or subcontractor personnel shall meet or exceed the requirements contained in ANSI B30.9 as determined by a qualified or registered engineer (competent in the field) and a certified load test.

Safe Working Loads	Safe working loads for specified types and sizes of ropes, slings, chains, and accessories shall be as set forth in this LIR and shall not be exceeded. For rigging items used in combination, the safe working load shall be that of the item with the lowest safe working load.
Posting Requirements	Posting requirements for the safe working load of ropes, slings, chains, accessories, and rigging equipment shall be conspicuously attached to all rigging and related equipment
Repair and Maintenance	The installation, maintenance, and repair of ropes, chains, slings, and rigging accessories shall be performed only by the manufacturer or other qualified person in accordance with the manufacturer's written instruction and tested at 125% of the rated load prior to use.
Inspections	<ul style="list-style-type: none">• Rigging used for material handling shall be inspected by a qualified person prior to use on each shift to ensure that it is in good repair and safe for use.• Written documentation of these inspections shall be made available to the HSR-5 SME or other qualified person upon request.• Defective equipment shall be immediately removed from service.

D.2 Below-Hook Lifting Devices and Job-Fabricated Rigging Hardware. – Use of below-hook lifting devices and job-fabricated rigging hardware shall be prohibited unless designed and certified by an engineer qualified in this field and the device or hardware meets the following requirements:

- tested successfully at 125% of the rated safe working load;
- certified in accordance with ANSI B30.20, “Below-Hook Lifting Devices”;

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- stamped with the weight, rated capacity, and serial number; and
- approved by HSR-5 or other qualified person.

D.3 Wire Rope

Protruding Ends	Protruding ends of strands in splices on slings and bridles shall be covered or blunted.
Hoisting Rope	Except for end fasteners, wire rope used in hoisting operations shall consist of one continuous run without knots or splices.
Prohibited Fastenings	Knots <i>shall not</i> be permitted for use in any hoisting operations. Wire rope clips may be used in accordance with manufacture recommended practices although this practice is strongly discouraged.
Sheave Diameter Requirements	<ul style="list-style-type: none">• The ratio between the rope diameter and the drum or sheave diameter shall not be less than the ratio specified by the equipment manufacturer.• When not specified by the equipment manufacturer, the ratio between the rope diameter and drum or sheave diameter shall be in accordance with the requirements contained in the ANSI standards.• Drums, sheaves, and pulleys shall be smooth and free of defects, which could damage the rope.• Sheave Groove Tolerance – Sheave groove tolerances shall be as recommended by the manufacturer of the sheave, block, drum, or pulley.
Lubrication	Wire rope shall be lubricated with the manufacturer's recommended lubricants at intervals warranted by the type of service.
Removal and Replacement	Wire rope with one or more of the following defects shall be immediately removed from hoisting or load-carrying service: Broken Wires. <ul style="list-style-type: none">• One or more valley breaks (i.e., a break occurring in the valley between two adjacent strands);• Six randomly broken wires in one rope lay or three broken wires in one strand in any one rope lay of running ropes;• Two broken wires in one lay in sections beyond the end connections or more than one broken wire at the end connection of standing ropes. Abrasion. Abrasion, scrubbing, flattening, or peening resulting in loss of more than one-third the original diameter of the outside wires. Kinking. Kinking, crushing, bird-caging, or other damage resulting in distortion of the rope structure. Heat Damage. Evidence of exposure to temperatures of 400°F or heat

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	damage resulting from open flame contact, excessive friction, or contact with electrical current. Reduction in Diameter. Reductions of more than 3/64 inch in the nominal diameter for rope diameters up to and including 3/4 inch; more than 1/16 inch for rope diameters from 7/8 through 1-1/8 inches; and more than 3/32 inch for rope diameters from 1-1/4 through 1-1/2 inches.
Marking Defective Rope	Wire rope removed from service because of defects shall be cut up and discarded or plainly marked as being unfit for load bearing service.
Hazardous Location	Running lines of stationary hoisting equipment located within eight feet of the ground or working level shall be guarded, or the pinch point hazard area shall be enclosed or barricaded.

D.4 Alloy Steel Chains

Safe Working Load	The safe working load shall not exceed the rated capacities set forth in 29 CFR 1926.251, Tables H-1 and H-2 (Click here).
Grade	Only heat-treated alloy steel chain slings stamped with an "A" on each link shall be used in hoisting operations.
Identification	Welded alloy steel chain slings shall have permanently affixed durable identification tags stating size, grade, rated capacity, and manufacturer.
Accessories	Hooks, rings, links, or other attachments used with alloy steel chains shall have a rated capacity at least equal to that of the chain. Job-made hooks, links, or makeshift fasteners formed from bolts, rods, etc., shall not be used.
Impact Loading	Chains shall not be subjected to impact loading. Any chain that is impact loaded shall be immediately removed from service.
Inspection	All Alloy Steel Chain Rigging shall be inspected for damage by a qualified person.

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Excessive Wear	Whenever wear at any point in any chain link exceeds that shown in the tables below, the chain shall be removed from service.			
	Maximum chain link wear acceptable for continued service:			
	Link Diameter	Maximum Allowable Wear	Link Diameter	Maximum Allowable Wear
	1/4 inch	3/64 inch	1 inch	3/16 inch
	3/8 inch	5/64 inch	1-1/8 inches	7/32 inch
	1/2 inch	7/64 inch	1-1/4 inches	1/4 inch
	5/8 inch	9/64 inch	1-3/8 inches	9/32 inch
	3/4 inch	5/32 inch	1-1/2 inches	5/16 inch
	7/8 inch	11/64 inch	1-3/4 inches	11/32 inch

D.5 Slings

Safe Working Load	The safe working loads of slings shall not exceed the stated capacities set forth in 29 CFR 1926.251, Tables H-1 through H-18 (Click here). For types of slings not included in these tables, the manufacturer's recommended safe working load for the specific working angle of loading shall be implemented, provided that a minimum safety factor of 5 to 1 is maintained.
Protection	Slings shall be protected from sharp, rough, or square corners by softeners. Storage shall be provided for slings not in use to ensure protection against damage that may impair their strength.
Removal from service	Chain, wire rope, fiber, and synthetic web slings shall be inspected by a qualified person at the start of each shift and after every critical lift. Slings shall be removed from service when wear exceeds that set forth in the OSHA standards, ANSI tables, or manufacturer's recommendations.

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D.6 Synthetic Web Slings

Synthetic Web Slings	Removal criteria: <ul style="list-style-type: none">• Acid or caustic burns;• Melting or charring of any part of the sling surface;• Snags, punctures, tears, or cuts;• Broken or worn stitches;• Distortion of fittings; or• Lack of sling identification tag.
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D.7 Shackles

Safe Working Load. The table below list the safe working loads that shall apply to shackles.

Guidance Note: Higher safe working loads may be permissible when recommended by the manufacturer for specific identifiable products, provided that a minimum safety factor of five to one is maintained.

Safe Working Load	Material Size	Pin Diameter	Safe Working Load
	1/2 inch	5/8 inch	1.4 Tons
	5/8 inch	3/4 inch	2.2 Tons
	3/4 inch	7/8 inch	3.2 Tons
	7/8 inch	1 inch	4.3 Tons
	1 inch	1-1/8 inches	5.6 Tons
	1-1/8 inch	1-1/4 inches	6.7 Tons
	1-1/4 inch	1-3/8 inches	8.2 Tons
	1-3/8 inch	1-1/2 inches	10 Tons
	1-1/2 inch	1-5/8 inches	11.9 Tons
	1-3/4 inch	2 inches	16.2 Tons
	2 inch	2-1/4 inches	21.2 Tons
Hoisting	Shackles used for hoisting shall be forged alloy steel and shall be of the locking or secured pin type.		
Wear or Damage	Shackles that are bent, distorted, or whose crown or pin is more than 10% worn shall be removed from service.		

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D.8 Hooks

Safe Working Load. The manufacturer's recommendations shall be implemented in determining the safe working load for the specific size and type of hook used. Hooks for which no manufacturer's recommendations are available shall be tested at twice the intended safe working load prior to being placed in service. The operations manager shall maintain a written record of these load tests.